



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/961,034	09/21/2001	Madhav Datta	884.522US1	4706

21186 7590 04/09/2003

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER

PHAM, LONG

ART UNIT PAPER NUMBER

2814

DATE MAILED: 04/09/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/961,034

Applicant(s)

DATTA ET AL.

Examiner

Long Pham

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 and 23-39 is/are pending in the application.
- 4a) Of the above claim(s) 23-28 and 36-39 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 10, 11 and 29-35 is/are rejected.
- 7) ☒ Claim(s) 9 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

Art Unit: 2814

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of claims 1-11 and 29-35 in Paper No. 6 is acknowledged.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 2, 6, and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Akram (US '058).

Akram teaches a ball-limiting metallurgy (BLM) stack comprising (see all figures and their associated text):

a metal adhesion first layer 68 of titanium or Ti or Cr located on a metallization 54;

a metal second layer 70 of TiW alloy located on the metal adhesion first layer;

a metal third layer 72 Cu of located on the metal second layer;

an electrical conductive bump 82 located the metal third layer, wherein at least one of the metal second layer and the metal third layer comprises of copper.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 3, 4, 5, 8, 9, 10, 11, and 29-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akram (US '058) as applied to claims 1, 2, 6, and 7 above, and further in view of Nguyen (US '449), applicant's admitted prior art (AAPA) of this application, P. Annala et al. : "Electroplated ... Chip Interconnections", Physica Scripta, Vol. T69, 115-118, 1997, and David et al.

Akram fails to teach that the metal second layer or metal third layer is nitrided refractory metal as recited in present claims 5 and 8.

Nguyen teaches that nitrided refractory metal is a good diffusion barrier of copper. See col. 3, ln. 40-45.

It would have been obvious to one of ordinary skill in the art of making semiconductor devices to use metal second layer or metal third layer of nitrided refractory metal to obtain the above advantage.

Akram further fails to explicitly teach that an intermetallic layer is located between the metallization and the electrically conductive bump as recited in present claim 10.

However, it is noted that the intermetallic layer is inherently created between metals during processing.

Akram further fails to teach that the electrically conductive bump is Sn37Pb as recited in present claim 11.

AAPA teaches using an electrically conductive bump of Sn37Pb to form flip-chip. See page 1 of this application.

It would have been obvious to one of ordinary skill in the art of making semiconductor devices to use electrically conductive bump of Sn37Pb in the Akram's device to form flip chip as taught above.

Akram teaches a blm stack of Cr/TiW/Cu but fails to teach a blm stack of Cr or Ti/Cu/Ni as recited in present claims 3 and 4.

P. Annala et al. teach the use of a blm stack of Cr/Cu/Ni to enable electroplating process that provides an economical and reliable alternative for evaporation process in the fabrication of flip chip solder bumps. See pages 116 and 118.

It would have been obvious to one of ordinary skill in the art of making semiconductor devices to use a blm stack of Cr/Cu/Ni in Akram's device to achieve the above benefit.

Akram further fails to teach the ranges for the thicknesses of the metal first layer, the metal second layer, and the metal third layer or the copper stud as recited in present claims 29-35.

However, it would have been obvious to one of ordinary skill in the art of making semiconductor devices to determine the workable or optimal ranges for the thicknesses of the metal first layer, the metal second layer, and the metal third layer or the copper stud through routine experimentation and optimization to obtain optimal or desired device performance because the thicknesses of the metal first layer, the metal second layer, and the metal third layer or the copper stud are result-effective variables and there is no evidence indicating that the thicknesses of the metal first layer, the metal second layer, and the metal third layer or the copper stud are critical or produce any unexpected results and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

Art Unit: 2814

Akram further fails to the metal second layer is made of NiV as recited in present claim 30.

David et al. teaches a blm stack in which the metal second layer is made of NiV to provide seed for electroplating. See col. 2, line 60 to col. 3, line 15.

It would have been obvious to one of ordinary skill in the art of making semiconductor devices to use the metal second layer of NiV in Akram's device to obtain the benefit above.

Akram in view of David et al. teaches a blm stack that comprises first metal layer of Cr, the second metal layer of NiV, and the third metal layer of Cu but fails to teach that the second metal layer is made of Cu and the third metal layer is made of NiV as recited in present claims 32 and 33.

However, it is submitted that the mere reversing of materials of two elements are obvious in the absence of unexpected result.

Allowable Subject Matter

3. Claim 9 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

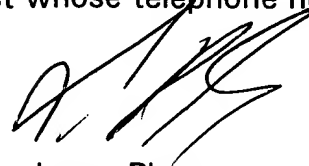
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Long Pham whose telephone number is 703-308-1092. The examiner can normally be reached on M-F, 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 703-308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are 703-746-4082 for regular communications and 703-746-4082 for After Final communications.

Art Unit: 2814

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



Long Pham

Primary Examiner

Art Unit 2814

L. P.

April 6, 2003